

## **Appendix I**

### **List of materials and instruments/equipment**

## A. List of materials used in the study

<b>N</b>	<b>Material</b>	<b>Manufacturer</b>
1	Chloramine T, BDH	Laboratory supplies, Poole, Dorset, England
2	X-ray films	Eastman Kodak Co., Rochester, New York, USA
3	Impression compound	Hoffmann Harvard Dental GmbH, Berlin, Germany
4	Barbed broach	Dentsply Maillefer, Ballaigues, Switzerland
5	K- files	Dentsply Maillefer, Ballaigues, Switzerland
6	Gates-Glidden drills	Dentsply Maillefer, Ballaigues, Switzerland
7	Clorox	Clorox (M) Industries Sdn Bhd, Kuala Lumpur, Malaysia
8	Monoject luerlok irrigation syringe with a 27-gauge needle	Sherwood Medical, St Louis, USA
9	Ethylenediaminetetraacetic acid (EDTA)	SmearClear™, SybronEndo, Orange, USA
10	Absorbent points	Dentsply Maillefer, Ballaigues, Switzerland
11	RealSeal™ obturation system	SybronEndo, Orange, USA
12	Dental gutta-percha	Kerr/SybronEndo, Romulus, USA
13	AH-Plus™ sealer	Dentsply De Trey, Konstanz, Germany
14	Finger spreaders, medium size	Kerr/SybronEndo, Romulus, USA
15	Elements RealSeal™ obturation cartridge	SybronEndo, Orange, USA
16	Elements Gutta-percha obturation cartridge	SybronEndo, Orange, USA
17	IRM	Dentsply Caulk, Milford, USA
18	Clear cold curing epoxy resin (Mirapox A, Mirapox B)	Miracon, Kuala Lumpur, Malaysia
19	Plastic cuvette	Dispolab-Kartell II, Milano, Italy

## B. List of instruments and equipment used in the study

N	Instrument/Equipment	Manufacturer
1	Ultrasonic Scaler	Piezon <sup>®</sup> Master 400, Nyon, Switzerland
2	X-ray unit	SIEMENS, Bensheim, Germany
3	Separating disc	BEGO, Breman, Germany
4	Handpiece	KaVo, Warthausen, Germany
5	Digital caliper	Mitutoyo/Digimatic, Tokyo, Japan
6	Locking tweezers	NORDENT 2 Stainless, Berlin, Germany
7	Endometer	Dentsply Maillefer, Ballaigues, Switzerland
8	Scalpel blade (No.15)	Miltex, York PA, USA
9	Elements <sup>™</sup> Obturation Unit	SybronEndo, Orange, USA
10	Buchanan Plugger, medium size	SybronEndo, Orange, USA
11	Root canal pluggers # 5, # 7, # 9 and # 11	Hu-Friedy Mfg Co., Chicago, USA
12	Light curing unit	Spectrum <sup>™</sup> 800, Dentsply Caulk, Milford, USA
13	Stopwatch	Citizen, Tokyo, Japan
14	Stereomicroscope	Kyowa Optical, Tokyo, Japan
15	Incubator	Memmert, Schwabach, Germany
16	Grinding machine	Grinder/Polisher, Metaserv <sup>®</sup> , Buehler Ltd, Illinois, USA
17	Low speed saw	ISOMET <sup>™</sup> Buehler <sup>®</sup> , Evanston, IL, USA
18	Digital ½ inch CCD video camera	Victor Company of Japan (JVC) Ltd., Yokohama, Japan
19	Zoom microscope	Edmund Industrial Optics, Tokyo, Japan
20	Image analysis system	Leica Qwin Colour (RGB), Cambridge, England
21	Field-emission gun scanning electron microscope (FESEM)	Low Vacuum Field Emission Gun, Quanta 200 F, FEI Company, Hillsboro, USA

## **Appendix II**

### **Data analysis**

## A. Compatibility between finger spreaders and accessory core materials

Medium size finger spreaders			
N	1mm	3mm	6mm
1	0.234	0.346	0.505
2	0.262	0.355	0.505
3	0.243	0.346	0.496
4	0.243	0.346	0.495
5	0.234	0.346	0.505
6	0.243	0.346	0.486
7	0.234	0.355	0.495
8	0.234	0.355	0.495
9	0.234	0.346	0.486
10	0.243	0.346	0.486
11	0.243	0.355	0.495
12	0.262	0.346	0.514
Mean	0.241	0.349	0.497

RealSeal™ core materials				Gutta-percha core materials			
N	1mm	3mm	6mm	N	1mm	3mm	6mm
1	0.206	0.318	0.495	1	0.224	0.336	0.447
2	0.196	0.308	0.468	2	0.224	0.336	0.486
3	0.215	0.327	0.495	3	0.224	0.337	0.467
4	0.215	0.337	0.505	4	0.215	0.327	0.477
5	0.206	0.336	0.486	5	0.196	0.346	0.477
6	0.234	0.336	0.505	6	0.206	0.327	0.495
7	0.196	0.318	0.495	7	0.215	0.346	0.477
8	0.234	0.336	0.486	8	0.196	0.327	0.495
9	0.215	0.327	0.486	9	0.206	0.327	0.477
10	0.206	0.327	0.505	10	0.215	0.336	0.486
11	0.234	0.336	0.477	11	0.224	0.336	0.477
12	0.215	0.336	0.505	12	0.206	0.336	0.495
13	0.224	0.346	0.495	13	0.225	0.346	0.486
14	0.215	0.308	0.477	14	0.215	0.327	0.477
15	0.224	0.336	0.505	15	0.215	0.336	0.486
16	0.206	0.355	0.486	16	0.224	0.255	0.477
17	0.206	0.327	0.477	17	0.215	0.308	0.477
18	0.224	0.346	0.495	18	0.196	0.336	0.486
19	0.187	0.318	0.477	19	0.215	0.336	0.486
20	0.196	0.346	0.477	20	0.216	0.346	0.477
21	0.216	0.346	0.505	21	0.224	0.327	0.486
22	0.206	0.327	0.505	22	0.224	0.346	0.486
23	0.215	0.336	0.486	23	0.224	0.346	0.477
24	0.234	0.346	0.495	24	0.206	0.346	0.505
Mean	0.214	0.333	0.491	Mean	0.214	0.332	0.482

## B. Time taken for obturation

N	LC/ RealSeal™	LC/ Gutta-percha	WC/ RealSeal™	WC / Gutta-percha
1	12.23	12.43	7.37	6.27
2	13.47	12.35	7.00	5.72
3	12.41	12.27	6.30	6.98
4	13.20	11.56	6.55	6.06
5	13.15	11.00	8.00	7.03
6	11.40	12.55	7.55	6.50
7	11.10	10.34	6.42	7.23
8	11.25	10.25	6.26	6.10
9	11.37	10.54	7.22	5.50
10	12.52	11.23	5.44	6.85
11	12.30	11.11	8.30	6.15
12	11.43	10.23	7.32	5.59
13	12.10	10.42	5.30	6.30
14	11.85	12.91	5.52	6.54
15	11.14	11.42	5.50	6.00
16	13.00	10.22	6.10	6.43

LC=Lateral compaction

WC=Warm vertical compaction

## C. Test of between-subjects effects

Dependent Variable: Obturation

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Observed Power(a)
Corrected Model	443.699(b)	3	147.900	221.165	.000	.917	1.000
Intercept	5295.291	1	5295.291	7918.413	.000	.992	1.000
Group	443.699	3	147.900	221.165	.000	.917	1.000
Error	40.124	60	.669				
Total	5779.114	64					
Corrected Total	483.823	63					

**P-value < 0.001**

**Partial Eta Squared >>> 0.14**

**Power > 99.99%**

**→ at least one pair of means differ significantly**

## D. Levene's test of equality of error variances

Dependent Variable: Obturation

F	df1	df2	Sig.
3.100	3	60	.033

### E. Multiple comparisons (Dunnett T3)

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.
LC/RealSeal™	LC/Gutta-percha	.8181	.30873	.072
	WC/ RealSeal™	5.4856(*)	.30817	.000
	WC/Gutta-percha	5.7919(*)	.23679	.000
LC/Gutta-percha	LC/RealSeal™	-.8181	.30873	.072
	WC/RealSeal™	4.6675(*)	.33334	.000
	WC/Gutta-percha	4.9738(*)	.26873	.000
WC/RealSeal™	LC/RealSeal™	-5.4856(*)	.30817	.000
	LC/Gutta-percha	-4.6675(*)	.33334	.000
	WC/Gutta-percha	.3063	.26808	.821
WC/Gutta-percha	LC/RealSeal™	-5.7919(*)	.23679	.000
	LC/Gutta-percha	-4.9738(*)	.26873	.000
	WC/RealSeal™	-.3063	.26808	.821

### F. Extrusion of filling materials

N	LC/ RealSeal™	LC/ Gutta-percha	WVC/ RealSeal™	WVCW/ Gutta-percha
1	No	Yes	No	No
2	Yes	No	No	No
3	No	No	No	Yes
4	No	No	Yes	No
5	No	No	Yes	Yes
6	No	No	No	No
7	No	No	No	No
8	No	No	No	Yes
9	Yes	No	No	No
10	No	No	Yes	No
11	No	No	Yes	No
12	No	No	No	Yes
13	No	No	No	No
14	No	No	No	No
15	No	No	Yes	No
16	No	No	No	No

LC=Lateral compaction

WC=Warm vertical compaction

### G. Chi-Square test

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.103	3	.251
Likelihood Ratio	4.362	3	.225
N of Valid Cases	64		

**H. Percentages of canal area occupied by filling core materials (RealSeal™ and gutta-percha), sealers and voids at L1 by using lateral compaction technique (LC)**

Specimen number	RealSeal™ obturation			Gutta-percha obturation		
	Filling cores	Sealer	Voids	Gutta-percha	Sealer	Voids
1	92.57%	7.03%	0.40%	82.07%	16.51%	1.42%
2	94.62%	3.81%	1.57%	77.50%	16.50%	6.00%
3	72.73%	26.18%	1.09%	63.18%	29.60%	7.22%
4	82.72%	15.74%	1.54%	73.84%	14.94%	11.22%
5	90.07%	9.67%	0.26%	58.92%	38.60%	2.48%
6	81.65%	17.40%	0.95%	73.85%	25.23%	0.92%
7	88.67%	9.85%	1.48%	80.89%	16.32%	2.79%
8	91.66%	7.33%	1.01%	91.38%	8.28%	0.34%
9	94.98%	4.98%	0.04%	92.79%	6.88%	0.33%
10	88.64%	10.09%	1.27%	78.28%	16.89%	4.83%
11	86.79%	11.27%	1.94%	89.59%	4.98%	5.43%
12	90.63%	8.88%	0.49%	88.23%	10.15%	1.62%
13	86.74%	11.14%	2.12%	67.20%	32.26%	0.54%
14	72.34%	23.72%	3.94%	90.96%	8.91%	0.13%
15	Discarded*	Discarded*	Discarded*	59.74%	36.90%	3.36%

\*Discarded due to dislodgement of RealSeal™ during sectioning



**I. Percentages of canal area occupied by filling core materials (RealSeal™ and gutta-percha), sealers and voids at L3 by using lateral compaction technique (LC)**

Specimen number	RealSeal™ obturation			Gutta-percha obturation		
	Filling cores	Sealer	Voids	Gutta-percha	Sealer	Voids
<b>1</b>	83.33%	16.38%	0.29%	82.37%	11.51%	6.12%
<b>2</b>	96.21%	2.78%	1.01%	78.72%	20.46%	0.82%
<b>3</b>	89.82%	9.76%	0.42%	67.83%	27.39%	4.78%
<b>4</b>	91.61%	7.30%	1.09%	84.55%	13.70%	1.75%
<b>5</b>	89.73%	10.06%	0.21%	86.21%	12.5%	1.29%
<b>6</b>	90.31%	9.22%	0.47%	84.59%	14.07%	1.34%
<b>7</b>	80.66%	16.23%	3.11%	86.53%	10.57%	2.90%
<b>8</b>	94.84%	4.41%	0.75%	92.61%	7.32%	0.070%
<b>9</b>	88.79%	9.70%	1.51%	72.13%	13.11%	14.75%
<b>10</b>	79.44%	17.13%	3.43%	79.75%	16.36%	3.89%
<b>11</b>	90.05%	9.10%	0.85%	78.10%	17.14%	4.76%
<b>12</b>	88.07%	10.86%	1.07%	76.83%	16.26%	6.91%
<b>13</b>	89.47%	9.21%	1.32%	71.77%	25.81%	2.42%
<b>14</b>	92.73%	3.81%	3.46%	80.56%	16.68%	2.76%
<b>15</b>	88.53%	10.54%	0.93%	Discarded*	Discarded*	Discarded*

\*Discarded due to dislodgement of gutta-percha during sectioning

**J. Percentages of canal area occupied by filling core materials (RealSeal™ and gutta-percha), sealers and voids at L6 by using lateral compaction technique (LC)**

Specimen number	RealSeal™ obturation			Gutta-percha obturation		
	Filling cores	Sealer	Voids	Gutta-percha	Sealer	Voids
<b>1</b>	90.62%	8.45%	0.93%	98.20%	1.20%	0.6%
<b>2</b>	94.36%	3.33%	2.31%	95.61%	2.90%	1.49%
<b>3</b>	94.96%	3.41%	1.63%	85.17%	11.59%	3.24%
<b>4</b>	89.91%	9.21%	0.88%	88.19%	8.56%	3.25%
<b>5</b>	91.51%	7.55%	0.94%	92.94%	4.89%	2.17%
<b>6</b>	87.38%	10.36%	2.26%	92.19%	3.69%	4.12%
<b>7</b>	81.85%	17.12%	1.03%	88.29%	10.15%	1.56%
<b>8</b>	91.89%	7.58%	0.53%	91.45%	6.33%	2.22%
<b>9</b>	94.40%	5.10%	0.50%	90.71%	7.24%	2.05%
<b>10</b>	91.91%	5.60%	2.49%	83.96%	13.21%	2.83%
<b>11</b>	91.03%	7.23%	1.74%	85.11%	12.5%	2.39%
<b>12</b>	91.32%	8.03%	0.65%	91.79%	5.94%	2.27%
<b>13</b>	88.46%	8.22%	3.32%	92.72%	5.90%	1.38%
<b>14</b>	81.94%	16.12%	1.94%	92.09%	7.57%	0.34%
<b>15</b>	93.06%	5.50%	1.44%	93.03%	5.58%	1.39%

**K. Percentages of canal area occupied by filling core materials (RealSeal™ and gutta-percha), sealers and voids at L1 by using warm vertical “continuous wave” technique (WVCW)**

Specimen number	RealSeal™ obturation			Gutta-percha obturation		
	Filling cores	Sealer	Voids	Gutta-percha	Sealer	Voids
1	87.95%	9.46%	2.59%	82.20%	16.81%	0.99%
2	86.62%	11.55%	1.83%	82.49%	10.60%	6.91%
3	79.00%	12.50%	8.50%	92.02%	6.18%	1.80%
4	74.78%	24.34%	0.88%	95.98%	3.57%	0.45%
5	87.27%	10.82%	1.91%	78.08%	16.04%	5.88%
6	90.48%	9.26%	0.26%	85.94%	3.30%	10.76%
7	85.19%	13.64%	1.17%	80.41%	12.70%	6.89%
8	90.99%	4.29%	4.72%	94.01%	5.69%	0.30%
9	71.34%	26.04%	2.62%	65.11%	33.83%	1.06%
10	81.44%	17.84%	0.72%	81.18%	17.42%	1.40%
11	93.01%	6.38%	0.61%	85.71%	13.30%	0.99%
12	91.55%	7.61%	0.84%	63.68%	28.36%	7.96%
13	88.08%	6.22%	5.70%	88.11%	10.97%	0.92%
14	81.60%	15.28%	3.12%	76.67%	15.94%	7.39%
15	Discarded*	Discarded*	Discarded*	76.78%	21.52%	1.70%

\*Discarded due to dislodgement of RealSeal™ during sectioning

**L. Percentages of canal area occupied by filling core materials (RealSeal™ and gutta-percha), sealers and voids at L3 by using warm vertical compaction technique (WVCW and WVIC)**

Specimen number	RealSeal™ obturation			gutta-percha obturation		
	Filling cores	Sealer	Voids	Gutta-percha	Sealer	Voids
<b>1</b>	85.92%	11.24%	2.84%	89.31%	7.24%	3.45%
<b>2</b>	90.97%	6.95%	2.08%	81.90%	15.93%	2.17%
<b>3</b>	91.95%	7.41%	0.64%	86.28%	11.16%	2.56%
<b>4</b>	93.28%	5.06%	1.66%	81.87%	17.05%	1.08%
<b>5</b>	93.06%	6.53%	0.41%	92.75%	6.78%	0.47%
<b>6</b>	85.76%	10.68%	3.56%	96.15%	3.62%	0.23%
<b>7</b>	88.72%	8.27%	3.01%	90.42%	8.68%	0.90%
<b>8</b>	91.83%	7.08%	1.09%	89.01%	8.60%	2.39%
<b>9</b>	84.1%	14.75%	1.15%	87.43%	11.28%	1.29%
<b>10</b>	91.53%	7.26%	1.21%	93.75%	5.38%	0.87%
<b>11</b>	87.99%	5.65%	6.36%	93.09%	3.51%	3.40%
<b>12</b>	83.47%	15.47%	1.06%	87.36%	12.16%	0.48%
<b>13</b>	95.08%	2.95%	1.97%	85.54%	8.97%	5.49%
<b>14</b>	97.39%	1.68%	0.93%	85.2%	10.00%	4.80%
<b>15</b>	93.38%	5.03%	1.59%	73.59%	23.51%	2.90%

**M. Percentages of canal area occupied by filling core materials (RealSeal™ and gutta-percha), sealers and voids at L6 by using warm vertical compaction of injected materials (WVCI)**

Specimen number	RealSeal™ obturation			gutta-percha obturation		
	Filling cores	Sealer	Voids	Gutta-percha	Sealer	Voids
<b>1</b>	97.61%	2.08%	0.31%	98.59%	1.21%	0.20%
<b>2</b>	95.24%	4.18%	0.58%	92.90%	6.80%	0.30%
<b>3</b>	97.00%	2.82%	0.18%	93.29%	6.21%	0.50%
<b>4</b>	97.05%	2.95%	Zero	93.88%	5.12%	1.00%
<b>5</b>	95.56%	3.61%	0.83%	92.57%	6.85%	0.58%
<b>6</b>	94.32%	3.73%	1.95%	95.52%	3.37%	1.11%
<b>7</b>	97.44%	1.94%	0.62%	92.76%	7.00%	0.24%
<b>8</b>	98.53%	1.15%	0.32%	99.52%	0.48%	Zero
<b>9</b>	95.12%	4.16%	0.72%	92.24%	5.52%	2.24%
<b>10</b>	98.87%	0.91%	0.22%	94.59%	3.91%	1.50%
<b>11</b>	95.87%	3.34%	0.79%	95.33%	4.17%	0.50%
<b>12</b>	97.62%	1.68%	0.70%	96.94%	2.74%	0.32%
<b>13</b>	97.00%	2.86%	0.14%	95.58%	3.43%	0.99%
<b>14</b>	Discarded*	Discarded*	Discarded*	97.37%	1.98%	0.65%
<b>15</b>	97.38%	2.40%	0.22%	99.11%	0.62%	0.27%

\*Discarded due to dislodgement of RealSeal™ during sectioning

## N. Overall: Test of normality

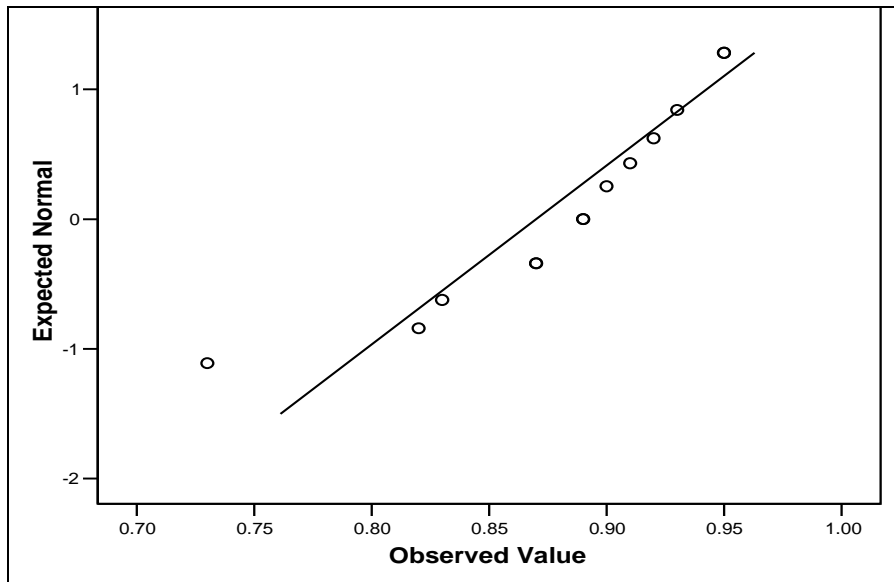
	Kolmogorov-Smirnov(a)		
	Statistic	df	Sig.
Filling cores	.187	29	.011
Sealers	.199	29	.005
Voids	.257	29	.000

**All not normally distributed**

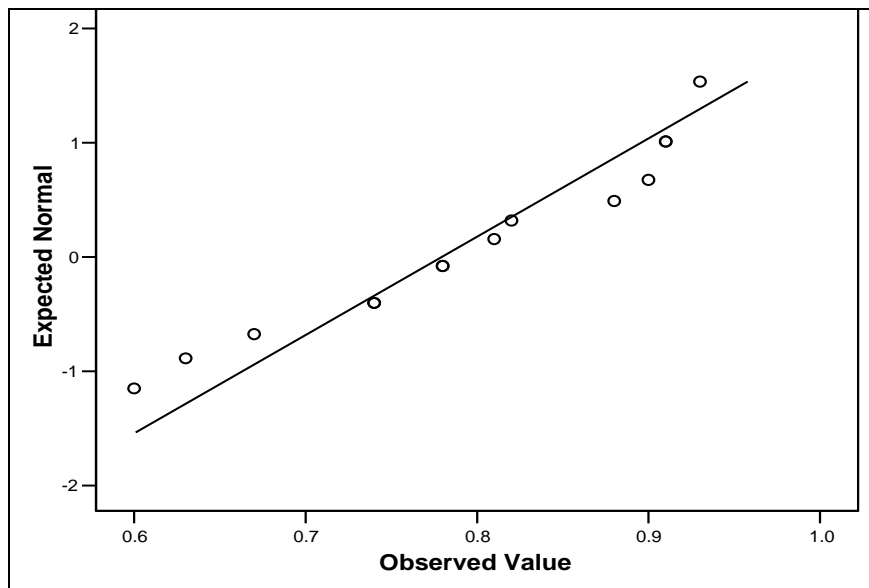
## O. By Types: Test of normality

	Type	Kolmogorov-Smirnov(a)		
		Statistic	df	Sig.
Filling cores	RealSeal™	.214	14	.081
	Gutta-percha	.140	15	.200
Sealer	RealSeal™	.270	14	.007
	Gutta-percha	.236	15	.025
Voids	RealSeal™	.219	14	.068
	Gutta-percha	.184	15	.185

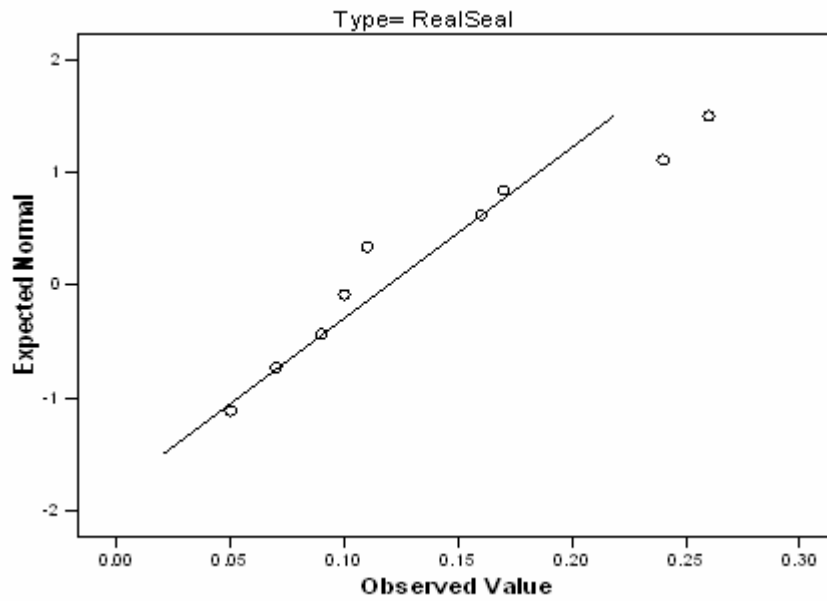
- 1. Filling cores and voids are normal for both types.**
- 2. Sealer not normal for both types.**



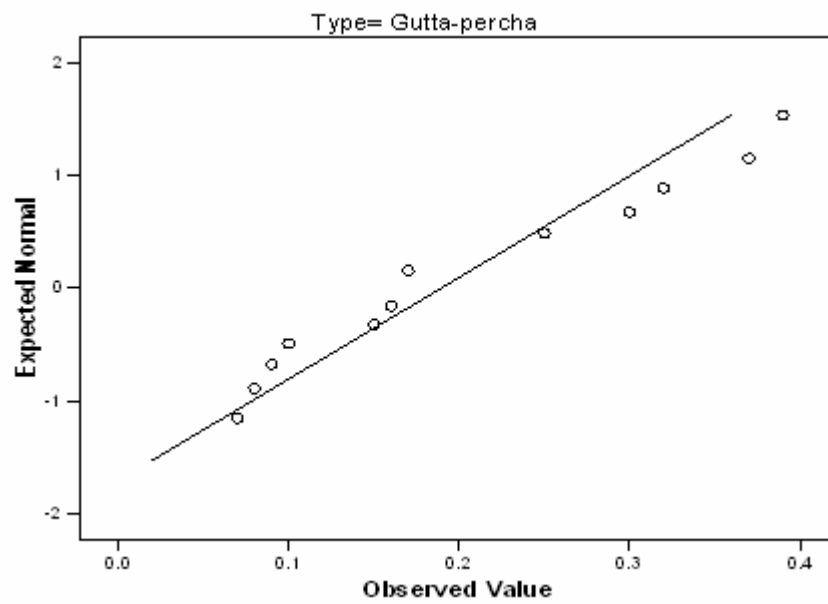
**Figure A. Distribution of the percentages of RealSeal™ core materials.**



**Figure B. Distribution of the percentages of gutta-percha.**

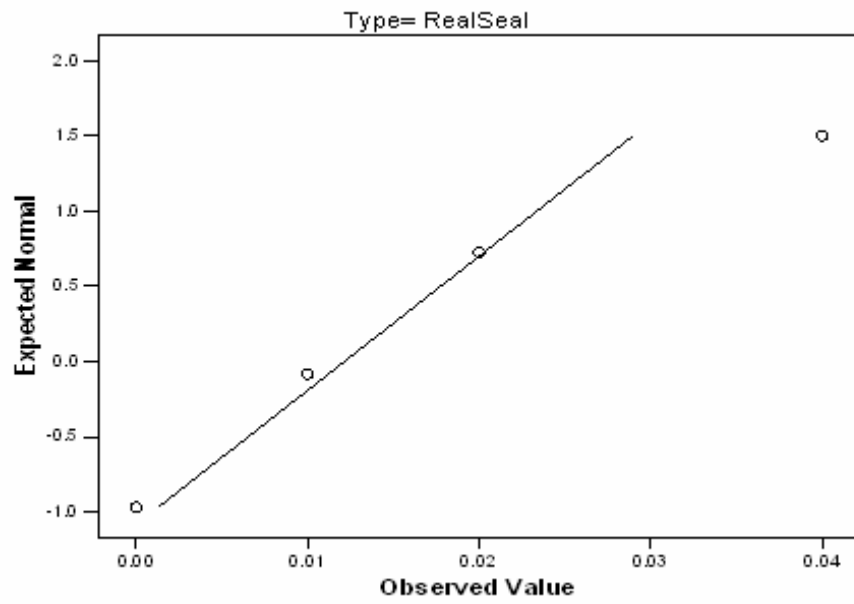


**Figure C. Distribution of the percentages of RealSeal™ sealer.**

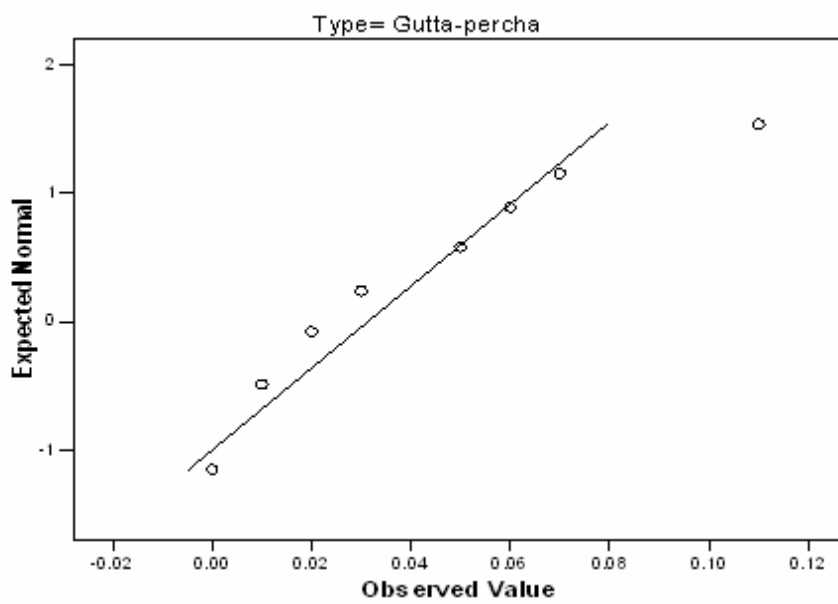


**Figure D. Distribution of the percentages of AH-Plus™ sealer.**





**Figure E. Distribution of the percentages of voids for RealSeal™ obturation.**



**Figure F. Distribution of the percentages of voids for gutta-percha obturation.**

## P. Reliability test for the evaluation of canal area (%)

Specimen number	First measurement			Second measurement		
	Filling cores	Sealer	Voids	Filling cores	Sealer	Voids
<b>wr2-1</b>	86.45%	12.11%	1.44%	86.55%	11.90%	1.55%
<b>wr10-6</b>	99.01%	0.82%	0.17%	98.90%	0.95%	0.15%
<b>wr3-6</b>	97.00%	2.82%	0.18%	97.00%	2.82%	0.18%
<b>wr4-3</b>	93.00%	5.22%	1.78%	93.20%	5.00%	1.80%
<b>wr14-3</b>	97.15%	2.14%	0.71%	97.30%	2.05%	0.65%
<b>lr2-1</b>	94.44%	4.52%	1.04%	94.60%	4.32%	1.08%
<b>lr3-6</b>	94.73%	3.51%	1.76%	94.86%	3.46%	1.68%
<b>lr3-1</b>	73.09%	25.78%	1.13%	73.00%	25.70%	1.30%
<b>lr9-6</b>	94.40%	5.10%	0.50%	94.40%	5.10%	0.50%
<b>lgp9-1</b>	92.60%	6.98%	0.42%	92.70%	6.93%	0.37%
<b>lgp13-1</b>	67.10%	32.25%	0.65%	67.00%	32.26%	0.74%
<b>lgp2-6</b>	95.46%	2.91%	1.63%	95.36%	3.09%	1.55%
<b>lgp5-3</b>	86.58%	12.12%	1.30%	86.46%	12.19%	1.35%
<b>lgp6-3</b>	84.87%	13.78%	1.35%	84.69%	14.00%	1.31%
<b>wgp15-6</b>	99.11%	0.61%	0.28%	99.11%	0.62%	0.27%
<b>wgp4-1</b>	95.90%	3.65%	0.45%	95.80%	3.67%	0.53%
<b>wgp10-3</b>	93.55%	5.48%	0.97%	93.51%	5.58%	0.91%
<b>wgp12-3</b>	87.16%	12.28%	0.56%	87.08%	12.29%	0.63%

### Q. Paired sample statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Filling cores.1	.9061	18	.08685	.02047
	Filling cores.2	.9067	18	.08711	.02053
Pair 2	Sealer.1	.0850	18	.08515	.02007
	Sealer.2	.0844	18	.08556	.02017
Pair 3	Voids.1	.0096	18	.0064	.0015
	Voids.2	.0100	18	.0069	.0016

### R. Paired sample correlation

		N	Correlation	Sig.
Pair 1	Filling cores.1 & Filling cores. 2	18	.999	.000
Pair 2	Sealer.1 & Sealer. 2	18	.999	.000
Pair 3	Voids.1 & Voids. 2	18	.931	.000

### S. Paired sample test

		t	df	Sig. (2-tailed)
Pair 1	Filling cores.1 - Filling cores. 2	-.566	17	.579
Pair 2	Sealer.1 – Sealer. 2	.566	17	.579
Pair 3	Voids.1 – Voids. 2	-.659	17	.518